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REPORT OF COMMITTEE ON STANDARDIZATION OF PETROLEUM SPECIFICATIONS

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Standardization of Gasoline Specifications.

EARLY IN 1919 the oil trade represented to the Committee on Standardization of Petroleum Specifications that the specifications of October, 1918, had become unnecessarily stringent and under existing conditions would, if universally adopted, unnecessarily restrict the total production of motor gasoline in this country. A change in specifications was requested.

The specifications adopted by the Committee on Standardization of Petroleum Specifications, October, 1918, under the United States Fuel Administration, promulgated in Bulletin No. 1, were drafted to cover Federal purchases of motor gasoline for domestic and military uses, and represented a grade equivalent to the larger proportion of motor gasolines being marketed in this country in the calendar years 1917 and 1918. Although these specifications had been drafted solely for Government use they were, nevertheless, voluntarily adopted by several States and municipalities, as standards for the sale of motor gasoline. In recognition of the fact that whatever the intent or opinions of this committee the specifications were likely to be prescribed as standards in laws enacted by various legislative bodies to govern the sale of gasoline to the public, the committee deemed it advisable to propose only such specifications as would be reasonably satisfactory in use, and if adopted universally, would not too greatly restrict the total available supply and thus be detrimental to the public good.

The committee was faced with the problem of determining what was a practical specification for motor gasoline, having regard to the total available supply and to satisfactory use in the motor. Obviously, both these factors are changing and it was fully recognized that the system of devising specifications must be flexible and permit revision from time to time as changing conditions of supply and use warranted. The difficulties of determining what was a satisfactory gasoline were also recognized. There could be no absolute standard because of varying conditions of use, such as engine construction and conditions, lubrication, climatic conditions, the personality of the driver, and many other elements, but the specifications could cover what experience had proved to be generally satisfactory under conditions as they exist to-day.

To obtain information on the subject, the Bureau of Mines made a survey of the gasoline marketed throughout the entire country, and

collected through its agents a total of 836 samples, covering practically all the types of gasoline produced and sold. Samples were obtained in every State, and included the products of all refineries of sufficient size to be of importance in the aggregate supply. The data collected in this survey are believed to be the most comprehensive now available with regard to the grades and quality of motor fuel now on the market.

Order By the President.

The President, under date of July 31, 1918, issued the following order:

Whereas, in order to avoid duplication of effort and in the interest of economy and the more efficient concentration of the Government and for the better utilization of resources and industries, it is desirable that there shall be a standardization of specifications for the supply of petroleum and its products to the United States Government.

Now, therefore, I, Woodrow Wilson, President of the United States, by virtue of the authority vested in me as Chief Executive, and by virtue of the powers conferred on me by the act of Congress, entitled "An act authorizing the President to coordinate or consolidate executive bureaus, agencies, and offices, and for other purposes, in the interest of economy and the more efficient concentration of the Government," approved May 20, 1918, do hereby order that the functions, power, and duty of preparing and adopting specifications for the supply of petroleum and its products to any and all departments, bureaus, agencies, and offices of the Government be transferred to and exercised by the United States Fuel Administrator. The United States Fuel Administrator shall exercise such functions, powers, and duties through a Committee on Standardization of Petroleum Specifications which shall be composed of the following members: A chairman who shall be appointed by the United States Fuel Administrator; one member who shall be appointed by the Secretary of War; one member who shall be appointed by the Secretary of the Navy; one member who shall be appointed by the chairman of the Shipping Board; one member who shall be appointed by the Director General of the Railroad Administration; one member who shall be appointed by the Director of the Bureau of Mines; and one member who shall be appointed by the Director of the Bureau of Standards. The specifications so prepared and adopted shall be binding upon and govern all departments, bureaus, agencies, and offices of the Government. It shall further be the duty of the United States Fuel Administrator, acting through said Committee on Standardization of Petroleum Specifications, to take all proper means to bring about a standardization of petroleum specifications for the purchases in the United States of the allied Governments.

This order shall be and remain in full force and effect during the continuance of the present war, and for six months after the termination thereof by the proclamation of a treaty of peace, or until amended, modified, or rescinded.

Committee and Advisers.

The Committee on Standardization of Specifications for Petroleum Products is composed of the following:

Mr. M. L. Requa, chairman.

Mr. H. H. Hill, appointed by the Director of the Bureau of Mines.

Admiral R. S. Griffin, appointed by the Secretary of the Navy.

Capt. F. M. Sanderson, appointed by the Secretary of War.

Dr. C. W. Waidner, appointed by the Director of the Bureau of Standards.

Dr. H. L. Doherty, appointed by the chairman of the Shipping Board.

Mr. C. B. Young, appointed by the Director General of the Railroad Administration.

Acting as technical advisers to this committee were the following:

Dr. G. W. Gray, representing Mr. M. L. Requa, chairman.

Commander H. A. Stuart, representing Admiral R. S. Griffin, appointed by the Secretary of the Navy.

Capt. F. M. Sanderson, representing Capt. Sanderson, appointed by the Secretary of War.

Mr. H. H. Hill, representing Mr. H H. Hill, appointed by the Director of the Bureau of Mines.

Mr. G. A. Kramer, representing Dr. C. W. Waidner, appointed by the Director of the Bureau of Standards.

Dr. M. E. McDonnell, representing Mr. C. B. Young, appointed by the Director General of the Railroad Administration.

Dr. R. G. Griswold, representing Mr. H. L. Doherty, appointed by the chairman of the Shipping Board.

With the data of the Bureau of Mines, which represented the results of the tests of a total of 836 samples of gasoline collected throughout the country, the technical subcommittee on the Standardization of Petroleum Specifications met in the conference room of the Bureau of Mines on Monday, September 29, 1919, to consider recommending a change in the specifications of motor gasoline and to consider lubricating oil specifications. The result of this meeting was to recommend back to the Committee on Standardization of Petroleum Specifications the adoption of the method of tests and specifications as hereinafter indicated.

A public invitation was extended to all interested representatives of the trade to be present at an informal meeting of the subcommittee at 10.30 a. m., September 29, 1919. The meeting was held for the purpose of discussing the proposed revision of the old recommendations and receiving such suggestions as might be offered from the trade.

The Committee on Standardization of Petroleum Specifications, after considering the report of the technical subcommittee, approved its findings, whereupon the Committee on Standardization of Petroleum Specifications adopted the methods of test and specifications on the commodities as shown below in full.

Those members of the committee who gave their approval were as follows: Mr. H. H. Hill, Admiral R. S. Griffin, Capt. F. M. Sanderson, Dr. C. W. Waidner, and Mr. H. L. Doherty. Not voting: Mr. C. B. Young.

Preliminary Changes.

1. The end point of gasoline to be raised to 225° C. (437° F.).
2. The 90 per cent point of gasoline to be raised to 190° C. (374° F.).
3. The reading at the 45 per cent point to be replaced by the reading at the 50 per cent point, and the temperature raised 5° C. (9° F.).
4. All reference to gravity to be eliminated from all specifications for lubricating oils.

Revised Specifications for Motor Gasoline.

Quality.—Gasoline to be high grade, refined, and free from water and all impurities, and shall have a vapor tension not greater than 10 pounds per square inch at 100° F. temperature, same to be determined in accordance with the current "rules and regulations for the transportation of explosives and other dangerous articles by freight," as issued by the Interstate Commerce Commission.

Inspection.—Before acceptance the gasoline will be inspected. Samples of each lot will be taken at random. These samples immediately after drawing will be retained in a clean, absolutely tight closed vessel and a sample for test taken from the mixture in this vessel directly into the test vessel.

Specifications.—

(*a*) Boiling point must not be higher than 60° C. (140° F.).
(*b*) 20 per cent of the sample must distill below 105° C. (221° F.).
(*c*) 50 per cent must distill below 140° C. (284° F.).
(*d*) 90 per cent must distill below 190° C. (374° F.).
(*e*) The end or dry point of distillation must not be higher than 225° C. (437° F.).
(*f*) Not less than 95 per cent of the liquid will be recovered in the receiver from distillation.

Test.—One hundred cubic centimeters will be taken as a test sample. The apparatus and method of conducting the distillation test shall be that adopted by sub-Committee XI of Committee D–1 of the American Society for Testing Materials,[a] with the following modifications:

First. The temperature shall be read against fixed percentage points; and, second, the thermometer shall be as hereinafter described:

Flask.

The flask used shall be the standard 100 c. c. Engler flask, described in the various textbooks on petroleum. Dimensions are as follows:

Dimensions of flask.

Dimensions.	Centimeters.	Inches.
Outside diameter of bulb	6.5	2.56
Outside diameter of neck	1.6	.63
Length of neck	15.0	5.91
Length of vapor tube	10.0	3.94
Outside diameter of vapor tube	.6	.24

[a] American Society for Testing Materials, Yearbook for 1915, pp. 568–569; or part 1, Committee on Reports, 1916, vol. 16, pp. 518–521. Dean, E. W., Motor gasoline; properties, laboratory methods of testing, and practical specifications: Tech. Papers 166 and 214, Bureau of Mines, 1917 and 1919, 27 and 32 pp. respectively.

Position of vapor tube, 9 cm. (3.55 inches) above the surface of the gasoline when the flask contains its charge of 100 c. c. The tube is approximately in the middle of the neck. The observance of the prescribed dimensions is considered essential to the attainment of uniformity of results.

The flask shall be supported on a ring of asbestos having a circular opening $1\frac{1}{4}$ inches in diameter; this means that only this limited portion of the flask is to be heated. The use of wire gauze is forbidden.

Condenser.

The condenser shall consist of a thin-walled tube of metal (brass or copper) $\frac{1}{2}$ inch internal diameter and 22 inches long. It shall be set at an angle of 75° from the perpendicular and shall be surrounded with a cooling jacket of the trough type. The lower end of the condenser shall be cut off at an acute angle and shall be curved down for a length of 3 inches. The condenser jacket shall be 15 inches long.

Thermometer.

The thermometer shall be made of selected enamel-backed tubing, having a diameter between 5.5 and 7 mm. The bulb shall be of Jena normal or Corning normal glass; its diameter shall be less than that of the stem, and its length between 10 and 15 mm. The total length of the thermometer shall be approximately 380 mm. The range shall cover 0° C. (32° F.) to 270° C. (518° F.), with the length of the graduated portion between the limits of 210 to 250 mm. The point marking a temperature of 35° C. (95° F.) shall not be less than 100 mm. nor more than 120 mm. from the top of the bulb. For commercial use the thermometer may be graduated in the Fahrenheit scale.

The scale shall be graduated for total immersion. The accuracy must be within about 0.5° C. The space above the meniscus must be filled with an inert gas, such as nitrogen, and the stem and bulb must be thoroughly aged and annealed before being graduated.

Source of Heat in Gasoline Distillation.

The source of heat in distilling gasoline may be a gas burner, an alcohol lamp, or an electric heater.

Procedure and Details of Manipulation in Conducting Distillations.

1. If an electric heater is used, it is started first to warm it.

2. The condenser box is filled with water containing a liberal portion of cracked ice.

3. The charge of gasoline is measured into the clean, dry Engler flask from a 100 cubic centimeter graduate. The graduate is used as a receiver for distillates without any drying. This procedure eliminates errors due to incorrect scaling of graduates, and also avoids the creation of an apparent distillation loss due to the impossibility of draining the gasoline entirely from the graduate.

4. The above-mentioned graduate is placed under the lower end of the condenser tube so that the latter extends downward below the top of the graduate at least 1 inch. The condenser tube should be so shaped and bent that the tip can touch the wall of the graduate on the side adjacent to the condenser box. This detail permits distillates to run down the side of the graduate and avoids disturbance of the meniscus caused by the falling of drops. The graduate is moved occasionally to permit the operator to ascertain that the speed of distillation is right, as indicated by the rate at which drops fall. The proper rate is from 4 to 5 cubic centimeters per minute, which is approximately two drops a second. The top of the graduate is covered preferably by several thicknesses of filter paper, the condenser tube passing through a snugly fitting opening. This minimizes evaporation losses due to circulation of air through the graduate and also excludes any water that may drip down the outside of the condenser tube on account of condensation on the ice-cooled condenser box.

5. A boiling stone (a bit of unglazed porcelain or other porous material) is dropped into the gasoline in the Engler flask. The thermometer is equipped with a well-fitted cork and its bulb covered with a thin film of absorbent cotton (preferably the long-fibered variety sold for surgical dressing). The quantity of cotton used shall be not less than 0.005 nor more than 0.010 gram (5 to 10 milligrams). The thermometer is fitted into the flask with the bulb just below the lower level of the side neck opening. The flask is connected with the condenser tube.

6. Heat must be so applied that the first drop of the gasoline falls from the end of the condenser tube in not less than 5 or more than

10 minutes. The initial boiling point is the temperature shown by the thermometer when the first drop falls from the end of the condenser tube into the graduate. The operator should not allow himself to be deceived, as sometimes (if the condenser tube is not dried from a previous run) a drop will be obtained, and it will be some time before a second one falls; in this case the first drop should be ignored. The amount of heat is then increased so that the distillation proceeds at a rate of from 4 to 5 c. c. per minute. The thermometer is read as each of the selected percentage marks is reached. The maximum boiling point or dry point is determined by continuing the heating after the flask bottom has boiled dry until the column of mercury reaches a maximum and then starts to recede consistently.

7. Distillation loss is determined as follows: The condenser tube is allowed to drain for at least five minutes after heat is shut off, and a final reading taken of the quantity of distillate collected in the receiving graduate. The distillation flask is removed from the condenser and thoroughly cooled as soon as it can be handled. The condensed residue is poured into a small graduate or graduated test tube and its volume measured. The sum of its volume and the volume collected in the receiving graduate, subtracted from 100 c. c., gives the figure for distillation loss.